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# West Virginia University Agricultural Experiment Station

MORGANTOWN

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DEPARTMENT OF SOILS

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## ANALYSES OF ONE HUNDRED WEST VIRGINIA SOILS



BY

Firman E. Bear and Robert M. Salter

# THE STATE OF WEST VIRGINIA

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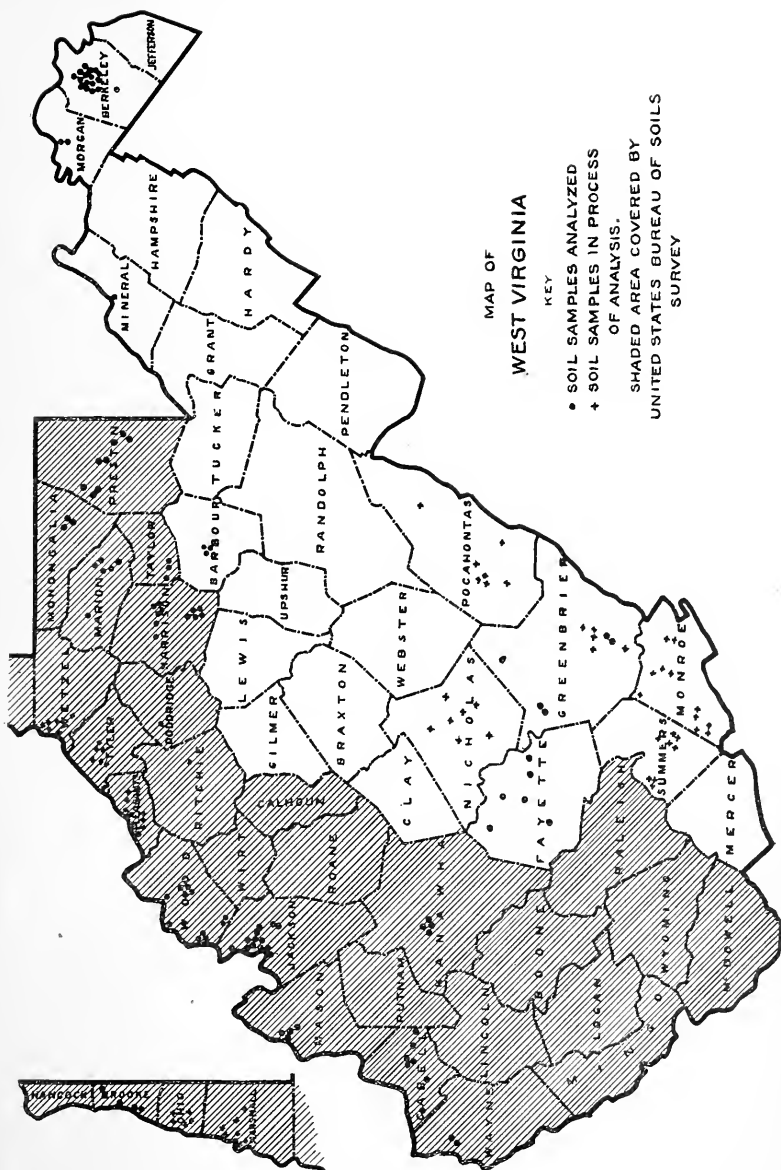
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†In co-operation with the University of Chicago.

\*In co-operation with the United States Department of Agriculture.



## CONCLUSIONS.

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These conclusions are summarized from the analyses of one hundred samples of West Virginia soils.

1. Fifty percent of these soils contain less than 1000 pounds of phosphorus per acre to a depth of  $6\frac{2}{3}$  inches. The use of acid phosphate on such soils would produce a marked increase in their crop-producing power.

2. Over forty percent of these soils contain less than 2500 pounds of nitrogen per acre to a depth of  $6\frac{2}{3}$  inches. Heavy yields of most crops cannot be produced on such soils until more nitrogen is present in them. This nitrogen can be secured from the air by growing legumes.

3. Ninety percent of these soils show a need of lime averaging over one ton of limestone per acre. Alfalfa and red clover cannot be grown to advantage on such soils until lime has been applied. Either ground limestone or burned lime can be used to advantage.

4. The amount of organic matter present in these soils is not half what it should be. The organic matter can be increased by growing larger crops and by plowing under cover crops and manure.

5. Eighty percent of these soils contain more than 20,000 pounds of potassium per acre to plow depth. If the other deficiencies in these soils were supplied, there should be sufficient available potassium to prevent its being a limiting factor.

# Analyses of One Hundred West Virginia Soils\*

By **FIRMAN E. BEAR** and **ROBERT M. SALTER.**

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It is the intention of the department of soils of the West Virginia Agricultural Experiment Station to make a study of the most important soil types in every county of the state and to determine the amounts of the various plant food elements contained in them. This bulletin is a preliminary report concerning the most prominent soil series together with the analyses of 100 samples chosen from certain sections of the state.

## SOIL SURVEYS OF THE UNITED STATES BUREAU OF SOILS.

The United States Bureau of Soils has been co-operating with the West Virginia Geological Survey in its work in this state. As each area is surveyed as to its mineral content it is also mapped as to its soil types. It has seemed advisable to accept the soil classification as outlined by the Bureau of Soils and to choose our samples as largely as possible from areas which have already been surveyed. Up to the present time one-half of the state has been mapped. The soil surveys are issued under authorization of Congress and the distribution provides 500 copies of each soil survey in the state for each of the senators from the state and 2000 copies of each survey for the congressman representing the district in which the survey is located. Soil surveys are available for the following counties and can be obtained by writing to the senators or to the congressmen representing the various districts:

Boone	Kanawha	Monongalia	Taylor
Brooke	Lincoln	Ohio	Tyler
Cabell	Logan	Pleasants	Upshur
Calhoun	McDowell	Preston	Wayne
Doddridge	Marion	Putnam	Wetzel
Hancock	Marshall	Raleigh	Wirt
Harrison	Mason	Ritchie	Wood
Jackson	Mingo	Roane	Wyoming

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\*For methods of analysis see Bulletin 159, West Virginia Agricultural Experiment Station, Morgantown.

Many of the soils, the analyses of which are given in this bulletin, have been chosen from the above named counties and represent definite soil types. Other samples have been chosen from areas which have not yet been surveyed and represent definite soil types which will be classified later when the soil survey of the state has been completed.

The Bureau of Soils\* has divided the United States into 13 soil provinces or regions. "A province is an area in which the soils have been produced by the same force or group of forces."

In West Virginia three provinces are represented:

- I. Limestone Valleys and Uplands Province.
- II. Appalachian Mountains and Plateaus Province.
- III. The River Flood Plains Province.

In each province there are several soil series. "A soil series is a group of soils having the same range in color, the same character of subsoil as regards color and structure, the same relief and drainage and a common or similar origin."

The following series are represented in West Virginia in the areas so far surveyed. This does not include the Eastern Panhandle or the soils of the types in Greenbrier and Pocahontas counties.

#### I. Limestone Valleys and Uplands Province

##### 1. Brooke series

- a. Soils grayish brown to brown.
- b. Subsoils yellowish brown to reddish brown clay.
- c. Soils derived from pure limestone with an occasional admixture of material from sandstone and shales.
- d. Soils with good drainage, fairly productive, easy to cultivate.

##### 2. Hagerstown series (Not surveyed as yet in West Virginia but present in limestone valley section of Greenbrier and Pocahontas and other eastern counties and in the Eastern Panhandle).

- a. Soils prevailing brown in color.
- b. Subsoils light brown to reddish brown.
- c. Soils derived from pure massive limestone.
- d. Soils very productive and suitable for most crops

#### II. Appalachian Mountains and Plateaus Province

##### 1. Dekalb series

- a. Soils gray to brown.
- b. Subsoils some shade of yellow.

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\*U. S. Bureau of Soils, Bulletin 96.



- c. Soils derived from sandstone and shales.
- d. Soils generally not very productive. (West Virginia Experiment Station farm is Dekalb soil.)
- 2. Meigs series
  - a. Soils variable in character from gray or pale yellow to red.
  - b. Subsoils variable.
  - c. Soils a mixture of Dekalb and Upshur.
  - d. Soils on hilly areas difficult to cultivate.
- 3. Upshur series
  - a. Soils Indian red.
  - b. Subsoils Indian red.
  - c. Derived from sandstone and shales, frequently calcareous in nature.
  - d. Generally fairly productive.
- 4. Westmoreland series
  - a. Soils grayish brown to yellowish brown.
  - b. Subsoils yellowish to yellowish brown.
  - c. Derived from sandstone and shales with interbedded limestone and calcareous shales.
  - d. Soils very productive.

### III. The River Flood Plains Province

#### A. Terrace Soils

- 1. Elk series
  - a. Soils light brown to brown.
  - b. Yellow subsoils.
  - c. Soils contain limestone, alluvium from Westmoreland series.
  - d. Soils fairly productive.
- 2. Holston series
  - a. Soils yellowish brown to brown.
  - b. Subsoils yellow.
  - c. Soils from sandstone and shale.
  - d. Only fairly productive.
- 3. Tyler series
  - a. Soils gray to grayish brown.
  - b. Subsoils yellowish to mottled yellow and gray.
  - c. Soils largely from sandstone and shale, poorly drained.
  - d. Not very productive.
- 4. Wheeling series
  - a. Soils brown to yellowish brown.
  - b. Subsoils gravelly.
  - c. Soils from glacial material.
  - d. Very productive.

- B. First Bottom Soils
5. Holly series
    - a. Soils gray.
    - b. Subsoils mottled gray and yellow.
    - c. Contain some limestone, poorly drained.
    - d. Not very productive.
  6. Huntington series.
    - a. Soils light brown to brown.
    - b. Subsoils yellow to light brown.
    - c. Contain some limestone.
    - d. Very productive.
  7. Moshannon series
    - a. Soils reddish brown to Indian red.
    - b. Subsoils reddish brown.
    - c. Soils from alluvium from Upshur series.
    - d. Very productive.

Table 1 shows the number of acres belonging to each series in the area so far surveyed.

TABLE 1.—Acres of Land in Various Soil Series  
in West Virginia.

Series	Acres
Dekalb .....	3,142,536
Meigs .....	2,718,848
Rough Stony Land.....	823,466
Huntington .....	360,576
Upshur .....	319,744
Westmoreland .....	166,080
Holston .....	120,512
Moshannon .....	62,592
Tyler .....	60,672
Brooke .....	47,232
Wheeling .....	40,770
Elk .....	31,872
Holly .....	27,520
Miscellaneous .....	12,928
Total .....	7,935,348

In each of these soil series there are several soil types. "A soil type is a soil which throughout the area of its occurrence has the same texture, structure, color, character of sub-soil, general topography, process of derivation, and usually derived from the same material." There may, therefore, be sands, silts, loams, and clays in each of the above series. For example, the soil on the West Virginia Agricultural Experiment Station farm is a Dekalb silt loam.

TABLE II†.—Pounds per 2,000,000 Lbs. of Surface Soil\*.

Sample Number	Owner of Farm	Postoffice	Soil Series	Nitrogen	Phosphorus	Potassium	Carbon	Limestone Required <sup>‡</sup>
<b>Barbour County</b>								
85-A	W. D. Zinn	Philippi	Tyler	3214	835	18600	35510	1800
90-A	W. D. Zinn	Philippi	?	4185	1236	27400	43910	3200
112-A	W. D. Zinn	Philippi	Upshur	4102	1236	49600	32210	1600
<b>Berkeley County</b>								
24-A	John Miller	Martinsburg	Hagerstown (?)	2358	1631	40600	19620	1000
25-A	John Miller	Martinsburg	?	2433	1420	51400	29120	1800
26-A	Back Creek	Hedgesville	Hagerstown (?)	1442	536	23800	22010	2400
27-A	Gray Silver	Martinsburg	?	2515	1150	40200	24960	1400
28-A	John Miller	Martinsburg	Hagerstown	2081	2020	53800	15480	800
29-A	Mrs. Lupton	Martinsburg	Hagerstown	2235	1086	49000	23030	0
30-A	Mr. Aler	Martinsburg	Soapstone	2478	1398	39200	24960	1800
31-A	A. R. Feltner	Martinsburg	Soapstone & Clay	1705	752	21600	20310	200
32-A	J. W. Stewart	Tabler	Hagerstown	2152	1282	49600	21660	0
33-A	D. Gold Miller	Martinsburg	Hagerstown (?)	2295	917	108800	23950	1000
34-A	Dr. Shipper	Gerrardstown	Hagerstown (?)	2558	1322	31200	26110	3000
35-A	Geo. Shroades	Gerrardstown	?	2602	1364	39000	18150	2400
36-A	H. L. Smith	Arden	?	2932	1035	143000	31720	1800
37-A	Gr. Golden Or. Co.	Martinsburg	Hagerstown (?)	2486	1327	55000	27290	2200
38-A	Senator Silver	Gerrardstown	Hagerstown (?)	3083	1117	52600	30480	0
<b>Brooke County</b>								
40-A	Robt. Underwood	Wellsburg	Huntington	5912	2648	38000	67010	3000
42-A	Robt. Patterson	Wellsburg	Brooke	3646	1365	48000	53010	0
111-A	.....	Follansbee	Wheeling	1940	1550	21600	.....	3600
114-A	Wm. Brady	Collier	Brooke (?)	3060	1125	31200	30970	2800
<b>Cabell County</b>								
4-A	Mr. Wilson	Ona	Meigs	1375	588	26800	19170	4400

†Credit is due E. B. Wells and M. F. Morgan for assistance in making these analyses.

\*This represents the amount of soil in a layer over an acre to a depth of 6½ inches.

TABLE II (Continued).—Pounds per 2,000,000 Lbs. of Surface Soil.

Sample Number	Owner of Farm	Postoffice	Soil Series	Nitrogen	Phosphorus	Potassium	Carbon	Limestone Required't
<b>Cabell County (Cont'd)</b>								
18-A	Mr. Clark	Ona	Upshur	2482	1218	49800	21620	0
21-A	Mr. Sios	Ona	Holston	1537	830	17600	15210	1400
22-A	C. R. Morris	Martha	Holston (?)	2893	2066	56600	31760	1800
74-A	Perry Lawson	Milton	Dekalb	1520	370	17200	21210	1000
75-A	J. H. Moore	Milton	Holston (?)	4344	1187	35400	62970	0
79-A	Ed. Kyle	Coxs Landing	Wheeling	1824	892	25600	17810	2000
84-A	John White	Culloden	Holston	1764	566	14400	20230	2200
<b>Doddridge County</b>								
113-A	J. E. Coleman	West Union	Holston (?)	3240	806	27800	34770	1800
<b>Fayette County</b>								
39-A	B. A. Fleshman	Fayetteville	Dekalb	1210	421	11000	25370	2200
58-A	L. V. Shawver	Corliss	Dekalb	2124	753	18400	48280	4600
61-A	T. C. Jones	Oak Hill	Dekalb	2082	483	16000	30550	2400
65-A	L. P. Wills	Mt. Cove	Dekalb	2602	662	11200	32450	2200
109-A	J. B. Kesler	Clifty	Dekalb	3384	660	20200	39490	2800
<b>Greenbrier County</b>								
44-A	L. E. McClung	Rupert	?	3116	1590	22000	54270	6800
45-A	J. O. McClung	Rupert	?	3680	708	17000	65800	4000
46-A	David Tuckwiller	Lewisburg	Soapstone	2824	1160	13800	28550	2600
47-A	Rev. H. A. Murrill	Lewisburg	Hagerstown (?)	2884	1289	27400	26560	1200
<b>Harrison County</b>								
1-A	Fred Whitman	Adamston	Westmoreland	2930	1226	42400	31330	2800
87-A	Arthur Sheets	Lost Creek	Dekalb	2750	706	22000	32140	3200
88-A	L. D. Blake	Lost Creek	Huntington	4324	1242	25000	-----	1800
91-A	A. H. Davidson	Lost Creek	Dekalb	4906	1219	22200	53090	1800
92-A	A. H. Davidson	Lost Creek	Dekalb	3142	902	25300	32140	1600
98-A	Arthur Sheets	Lost Creek	Elk	2534	706	17300	25690	2000

100-A	Jackson Arnold	Lost Creek	Huntington	5322	1362	27400	62360	3600
101-A	A. J. Lodge	.....	?	6406	1858	32200	70130	2200
103-A	A. A. Long & Bro.	Bridgeport	Huntington	5046	1553	28000	48450	1200
104-A	S. S. Farris	Bridgeport	Dekalb	3046	784	22600	29180	2200
106-A	R. E. L. Stout	Bridgeport	Elk	3274	1376	23800	29630	200
<b>Jackson County</b>								
48-A	Mr. Bradbury	Sherman	?	2330	1226	32400	29020	5600
49-A	W. C. Statts	Sherman	Huntington	2016	864	19000	54990	0
50-A	W. C. Statts	Sherman	Huntington	1995	1091	24200	36360	0
51-A	Virgil Bower	Crow Summit	Moshannon	2152	1034	21600	22640	2400
52-A	Ruben Pickens	Ravenswood	Dekalb	2042	1216	26600	20280	2000
53-A	F. A. Morgan	Ravenswood	Moshannon	1670	874	25000	16580	2600
54-A	F. A. Morgan	Ravenswood	Moshannon	2144	973	24200	23860	1400
55-A	Isaac Starkey	Ravenswood	Holston	2164	739	19400	22970	0
56-A	M. F. Morgan	Ravenswood	Upshur	1755	546	20800	21090	2600
57-A	M. F. Morgan	Ravenswood	Holston	1035	354	21400	16730	2800
83-A	W. A. Proctor	Ravenswood	Wheeling	3784	3636	23400	45810	0
102-A	Chas. Kalt	Crow Summit	Moshannon	2430	862	24800	16180	1800
<b>Jefferson County</b>								
5-A	C. D. Wysong	Shepherdstown	Hagerstown	2336	1218	51000	27150	0
<b>Kanawha County</b>								
43-A	E. C. Crane	Poca	Holston (?)	3322	1529	37200	31850	3200
107-A	Lewis Milam	Charleston	Dekalb	2610	653	25800	28780	2000
108-A	W. A. Lawson	Charleston	Dekalb	2224	434	16600	30580	1600
110-A	Geo. Johnson	Charleston	Holston	1890	715	10100	18020	2000
<b>Marion County</b>								
81-A	County Poor Farm	Fairmont	Westmoreland	2746	1020	35600	-----	2400
86-A	Mr. Meredith	Fairmont	Huntington (?)	3846	1119	27400	41380	3800
89-A	J. S. Nuzum	Colfax	Westmoreland	4076	1526	34800	-----	2000
95-A	J. F. Phillips	Fairmont	Elk	3280	997	23000	36220	0
96-A	L. N. Beatty	Mannington	Moshannon	3444	1226	32600	30470	3800
99-A	W. F. Boyers	Fairmont	Elk	2744	839	23200	26950	2000

TABLE II (Continued).—Pounds per 2,000,000 Lbs. of Surface Soil.

Sample Number	Owner of Farm	Postoffice	Soil Series	Nitrogen	Phosphorus	Potassium	Carbon	Limestone Requirement t
<b>Mason County</b>								
76-A	J. T. Kincaid	Pt. Pleasant	Holston	1615	649	22600	15490	1600
78-A	J. McCausland	Pt. Pleasant	Moshannon	3316	712	39000	31700	5200
80-A	Ira Z. Swisher	Pt. Pleasant	Huntington	2975	1557	22600	30050	2200
82-A	Jerome Plants	Ambrosia	Upshur	1760	425	39000	20990	3800
<b>Mineral County</b>								
20-A	Ed. Leatherman	Keyser	?	6485	776	7400	175630	3800
<b>Monongalia County</b>								
2-A	Exp. Station	Morgantown	Dekalb	.....	698	28400	22900	3000
16-A	Exp. Station	Morgantown	Dekalb	2058	718	26000	23140	3000
23-A	Geo. C. Sturgiss	Morgantown	?	6821	1630	30800	77210	2000
<b>Morgan County</b>								
10-A	Mr. Henry	Stotlers Cross Roads	Clay Loam	2272	891	18000	29000	2400
11-A	Mr. Henry	Stotlers Cross Roads	Silt Loam	3517	626	19000	16690	800
17-A	Somer's Orchard	Cherry Run	?	2331	798	30200	38080	4000
19-A	Somer's Orchard	Cherry Run	?	2357	925	29600	31400	1200
<b>Nicholas County</b>								
41-A	E. P. Foster	Gauley Bridge	Black Sand	2135	.....	1200	38630	5000
<b>Pleasants County</b>								
6-A	J. B. Kester	Belmont	Wheeling	3423	2248	23000	38460	3000
<b>Preston County</b>								
66-A	A. M. McMillen	Mason town	Dekalb	3374	697	20000	47230	1400
67-A	Sanford Watson	Mason town	Dekalb	4326	2159	26000	47320	1600
68-A	B. T. Gibson	Mason town	Holly	3984	923	24600	45700	1600
69-A	J. F. Copeman	Kingwood	Dekalb (?)	4746	2146	31000	49230	1400

70-A	County Farm	Kingwood	Dekalb	3870	1203	27000	41420	400
71-A	T. B. Taylor	Terra Alta	Upshur	2986	761	25600	37250	0
72-A	J. A. Dodge	Terra Alta	Dekalb	4142	1135	23400	48680	2600
<b>Ritchie County</b>								
60-A	J. F. Lowther	Pullman	Upshur	2802	.....	34800	26820	5000
<b>Roane County</b>								
97-A	C. C. Hardman	Spencer	Dekalb	2132	482	27400	22880	2200
<b>Taylor County</b>								
3-A	G. Smith	Flemington	?	4268	1603	32400	57590	2400
14-A	F. B. Haller	Rosemont	Westmoreland	2954	1181	25000	34360	3000
15-A	M. G. Lawson	Flemington	Elk	3699	1213	22000	40400	3400
<b>Wayne County</b>								
12-A	W. J. Smith	Centerville	Holston	2299	806	21200	26170	1200
13-A	W. F. Plymale	Centerville	Holston	3385	1148	33600	34280	3400
<b>Wood County</b>								
7-A	Mr. Creel	Davisville	Tyler	2686	1163	25200	27450	3400
8-A	J. A. Creel	Davisville	Upshur	2551	950	37600	25900	5200
9-A	J. A. Creel	Davisville	Dekalb	1669	680	26200	17601	1200
59-A	J. F. Doan	Parkersburg	Upshur	2077	.....	36400	18350	6400
62-A	J. W. Miller	Mineral Wells	Huntington	1550	782	18400	14150	800
63-A	E. J. Humphrey	Belleville	Huntington	2724	1457	14200	33680	800
64-A	A. F. Bonar	Belleville	Brooke	3004	1543	40200	30120	0
73-A	H. G. Butcher	Mineral Wells	Huntington	1970	918	34200	16490	2400
77-A	Mr. Barnett	Davisville	Tyler	3910	1108	34800	41380	5200
93-A	S. F. Romine	Washington	Dekalb	1904	586	22200	21790	1000
94-A	Dr. Keefer	Belleville	Wheeling	3496	1563	26200	31480	1400
<b>Wayne County, Ohio</b>								
115-A	Ohio Exp. Sta.	Wooster, Ohio	Volusia	1775	604	28600	.....	3200

TABLE III.—Pounds per 2,000,000 Lbs. of Surface Soil.

Sample Number	Owner of Farm	Postoffice	County	Nitrogen	Phosphorus	Potassium	Carbon	Limestone Requirement <sup>t</sup>
<b>Brooke Series</b>								
42-A	Robt. Patterson	Wellsburg	Brooke	3646	1365	48000	53010	0
64-A	A. F. Bonar	Belleville	Wood	3004	1543	40200	30120	0
114-A?	Wm. Brady	Collier	Brooke	3060	1125	31200	30970	2800
<b>Dekalb Series</b>								
2-A	Exp. Station	Morgantown	Monongalia	.....	698	28400	22900	3000
9-A	J. A. Creel	Davisville	Wood	1669	680	26200	17601	1200
10-A	Mr. Henry	Stotlers Cross Roads	Morgan	2272	891	18000	29000	2400
16-A	Exp. Station	Morgantown	Monongalia	2058	718	26000	23140	3000
39-A	B. A. Fleshman	Fayetteville	Fayette	1210	421	11000	25370	2200
52-A	Ruben Pickens	Ravenswood	Jackson	2042	1216	26600	20280	2000
58-A	L. V. Shawver	Corliss	Fayette	3124	753	18400	48280	4600
61-A	T. C. Jones	Oak Hill	Fayette	2082	483	16000	30550	2400
65-A	L. P. Wills	Mountain Cove	Fayette	2602	662	11200	32450	2200
66-A	A. F. McMillen	Masontown	Preston	3374	697	20000	47230	1400
67-A?	Sanford Watson	Masontown	Preston	4326	2159	26000	47320	1600
69-A?	J. F. Copeman	Kingwood	Preston	4746	2146	31000	49230	1400
70-A	County Farm	Kingwood	Preston	3870	1203	27000	41420	400
72-A	J. A. Dodge	Terra Alta	Preston	4142	1135	23400	48680	2600
74-A	Perry Lawson	Milton	Cabell	1520	370	17200	21210	1000
87-A	Arthur Sheets	Lost Creek	Harrison	2750	706	22000	32140	3200
90-A	W. D. Zinn	Philippi	Barbour	4185	1236	27400	43910	3200
91-A	A. H. Davidson	Lost Creek	Harrison	4906	1219	22200	53090	1800
92-A	A. H. Davidson	Lost Creek	Harrison	3142	902	25800	32140	1600
93-A	S. F. Romine	Washington	Wood	1904	586	22200	21790	1000
97-A	C. C. Hardman	Spencer	Roane	2132	482	23800	22880	2200
104-A	S. S. Farris	Bridgeport	Harrison	3046	784	22600	29180	2200
107-A	Lewis Milam	Charleston	Kanawha	2610	653	25800	28780	2000



108-A	W. A. Lawson	Charleston	Kanawha	2224	434	16600	30580	1600
109-A	J. B. Kessler	Clifty	Fayette	3384	660	20200	39490	2800
<b>Elk Series</b>								
15-A	M. G. Lawson	Flemington	Taylor	3699	1213	22000	40400	3400
95-A	J. F. Phillips	Fairmont	Marion	3280	997	23000	36220	0
98-A	Arthur Sheets	Lost Creek	Harrison	2534	706	17800	25690	2000
99-A	W. F. Boyers	Fairmont	Marion	2744	839	23200	26950	2000
106-A	R. E. L. Stout	Bridgeport	Harrison	3274	1376	23800	29630	200
<b>Hagerstown Series</b>								
5-A	C. D. Wyson	Shepherdstown	Jefferson	2336	1218	51000	27150	0
24-A?	John Miller	Martinsburg	Berkeley	2358	1631	40600	19620	1000
26-A?	Back Creek Or. Co.	Hedgesville	Berkeley	1442	536	23800	22010	2400
28-A	John Miller	Martinsburg	Berkeley	2081	2020	53800	15480	800
29-A	Mrs. Lupton	Martinsburg	Berkeley	2235	1086	49000	23030	0
32-A	J. W. Stewart	Tabler	Berkeley	2152	1282	49600	21660	0
33-A?	D. Gold Miller	Martinsburg	Berkeley	2296	917	108800	23950	1000
34-A?	Dr. Shipper	Gerrardstown	Berkeley	2558	1322	31200	26110	3000
37-A?	Gr. Golden Or. Co.	Martinsburg	Berkeley	2486	1327	55000	27290	2200
38-A?	Senator Silver	Gerrardstown	Berkeley	3083	1117	52600	30480	0
47-A	Rev. H. A. Murrill	Lewisburg	Greenbrier	2884	1289	27400	26560	1200
<b>Holston Series</b>								
12-A	W. J. Smith	Centerville	Wayne	2299	806	21200	26170	1200
13-A	W. F. Plymale	Centerville	Wayne	3385	1148	33600	34280	3400
21-A	Mr. Sios	Ona	Cabell	1537	830	17600	15210	1400
22-A?	C. R. Morris	Martha	Cabell	2893	2066	56600	31760	1800
43-A?	E. C. Crane	Poca	Kanawha	3322	1529	37200	31850	3200
55-A	Isaac Starkey	Ravenswood	Jackson	2164	739	19400	22970	0
57-A	M. F. Morgan	Ravenswood	Jackson	1035	354	21400	16730	2800
75-A	J. H. Moore	Milton	Cabell	4344	1187	35400	62970	0
76-A	J. T. Kincaid	Pt. Pleasant	Mason	1615	649	22600	15490	1600
84-A	John White	Culloden	Cabell	1764	566	14400	20230	2200

TABLE III (Continued).—Pounds per 2,000,000 Lbs. of Surface Soil.

Sample Number	Owner of Farm	Postoffice	County	Nitrogen	Phosphorus	Potassium	Carbon	Limestone Requirement
<b>Holston Series (Cont'd)</b>								
110-A	Geo. Johnson	Charleston	Kanawha	1890	715	10100	18020	2000
113-A	J. E. Coleman	West Union	Doddridge	3240	806	27800	34770	1800
<b>Holly Series</b>								
68-A	B. T. Gibson	Masontown	Preston	3984	923	24600	45700	1600
<b>Huntington Series</b>								
40-A	Robt. Underwood	Wellsburg	Brooke	5912	2648	38000	67010	3000
49-A	W. C. Statts	Sherman	Jackson	2016	864	19000	54990	0
50-A	W. C. Statts	Sherman	Jackson	1995	1091	24200	36360	0
62-A	J. W. Miller	Mineral Wells	Wood	1550	782	18400	14150	800
63-A	E. J. Humphrey	Belleville	Wood	2724	1457	14200	33680	800
73-A	H. G. Butcher	Mineral Wells	Wood	1970	918	34200	16490	2400
80-A	Ira Z. Swisher	Pt. Pleasant	Mason	2975	1557	22600	30050	2200
86-A	Mr. Meredith	Fairmont	Marion	3846	1119	27400	41380	3800
88-A	L. D. Blake	Lost Creek	Harrison	4324	1242	25000	-----	1800
100-A	Jackson Arnold	Lost Creek	Harrison	5822	1362	27400	62360	3600
103-A	A. A. Long & Bro.	Bridgeport	Harrison	5046	1553	28000	48450	1200
<b>Meigs Series</b>								
4-A	Mr. Wilson	Ona	Cabell	1375	588	-----	19170	4400
<b>Moshannon Series</b>								
51-A	Virgil Bower	Crow Summit	Jackson	2152	1034	21600	22640	2400
53-A	F. A. Morgan	Ravenswood	Jackson	1670	874	25000	16580	2600
54-A	F. A. Morgan	Ravenswood	Jackson	2144	973	24200	23860	1400
78-A	J. McCausland	Pt. Pleasant	Mason	3316	712	39000	31700	5200

96-A L. N. Beatty  
102-A Chas. Kalt

Mannington  
Crow Summit

Marion  
Jackson

3444  
2439

32600  
24800

30470  
16180

3800  
1800

#### Tyler Series

7-A Mr. Creel  
77-A Mr. Barnett  
85-A? W. D. Zinn

Davisville  
Davisville  
Philippi

Wood  
Wood  
Barbour

2680  
3910  
3214

25200  
34800  
18600

27450  
41380  
35510

3400  
5200  
1800

#### Upshur Series

8-A J. A. Creel  
18-A Mr. Clark  
56-A M. F. Morgan  
59-A J. F. Dean  
60-A J. F. Lowther  
71-A T. B. Taylor  
82-A Jerome Plants  
112-A W. D. Zinn

Davisville  
Ona  
Ravenswood  
Parkersburg  
Pullman  
Terra Alta  
Ambrosia  
Philippi

Wood  
Cabell  
Jackson  
Wood  
Ritchie  
Preston  
Mason  
Barbour

2551  
2482  
1755  
2077  
2802  
2986  
1760  
4102

37600  
49800  
20800  
36400  
34800  
25600  
39000  
49600

25900  
21620  
21090  
18350  
26820  
37250  
20990  
32210

5200  
0  
2600  
6400  
5000  
0  
3800  
1600

#### Westmoreland Series

1-A Fred Whitman  
14-A? F. B. Haller  
81-A Poor Farm  
89-A J. S. Nuzum

Adamston  
Rosemont  
Fairmont  
Colfax

Harrison  
Taylor  
Marion  
Marion

2930  
2954  
2746  
4076

42400  
25000  
35600  
34800

31330  
34360  
.....  
.....

2800  
3000  
2400  
2000

#### Wheeling Series

6-A J. B. Kester  
79-A Ed. Kyle  
83-A W. A. Procter  
94-A Dr. Keefer  
111-A .....

Belmont  
Coxs Landing  
Ravenswood  
Belleville  
Follansbee

Pleasants  
Cabell  
Jackson  
Wood  
Brooke

3423  
1824  
3784  
3496  
1940

23000  
25600  
23500  
26200  
21600

38460  
17810  
45810  
31480  
.....

3000  
2000  
0  
1400  
3600

## HISTORY OF SOIL SAMPLES.

**1-A.—Discard\*, 10.70%.** Hillside north of barn; cleared 40 to 50 years; soil, light gray; subsoil, yellowish; rolling highland; drainage, natural; bluegrass predominates in pasture; no manure applied, no fertilizer, no lime, no legumes grown; red clover does fairly well; sorrel is principal weed; soil varied more or less on side of hill and resulting sample was a composite representing several phases of this type of soil.

**2-A.—No discard.** (Plot 18) Soil, yellowish; level; taken from plot which has received no fertilizer or lime treatment for some time.

**3-A.—Discard, 2.13%.** Hickory, poplar, and sycamore originally grew on land; cleared approximately 75 years; soil, chocolate; subsoil, light brown; level overflow; drainage, natural; meadow since clearing, 2 tons per acre; timothy and orchard grass predominate; fed over in winter; no manure applied, no fertilizer, no lime; red clover with the grass; red clover apparently does well; yarrow, broad and narrow plantain, the principal weeds; limestone outcrops on hillside around flat.

**4-A.—Discard, 7.15%.** Top of hill back of barn; cleared one year; soil, light gray; subsoil, yellowish; rolling highland; drainage, natural; corn, 50 bushels per acre; no manure applied, no fertilizer, no lime; no legumes grown; do not know whether red clover does well or not; some sorrel. This represents new soil.

**5-A.—Discard 3.17%.** Between house and highway; white oak, hickory, walnut, and locust originally grew on land; cleared 100 years; soil, chocolate; subsoil, dark red; rolling highland; drainage, natural; corn each summer; rye each winter until this year (pasture); 38 bushels of corn per acre; 7 tons manure per acre each 3 years; 150 pounds of acid phosphate each year; 1 ton burned lime 12 years ago; hog weed, morning glory, Jamestown weed, the principal weeds; the field contains only about  $1\frac{1}{4}$  acres but the rotation of corn and rye each year for thirty years makes it interesting. Field is just outside the corporation limits of Shepherdstown.

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\*The discard represents the particles of shale and rock which would not pass a 2-mm. sieve. This part was separated from the sample before analysis was made.

**6-A.**—Discard, 2.27%. Northeast of dwelling; beech, hickory, and sugar originally grew on land; cleared 75 years; soil, chocolate; subsoil, chocolate to yellow; level terrace; drainage, natural; meadow 9/10 of time; 2 tons of hay per acre; timothy and red top predominate; 12 tons manure applied once in 4 years; 300 pounds mixed goods applied 4 years ago; no lime; no legumes grown; very few red clover plants present; sedge, cinquefoil, and blue devil, the principal weeds; about fifteen acres level land in field about 100 yards northeast of railroad depot.

**7-A.**—Discard, 3.72%. Along road west of cross roads; cleared 75 years; soil, light gray; subsoil, darker; level terrace; drainage, natural; corn, oats, wheat, and hay; some manure applied; red clover does not do very well; sorrel, the principal weed.

**8-A.**—Discard, 2.36%. Orchard back of barn; cleared 35 years; soil, red; subsoil, red; rolling highland; drainage, natural; clover has been grown; red clover does fairly well; sorrel, the principal weed.

**9-A.**—Discard, 2.38%. North of barn; cleared 50 years; soil, light yellow; subsoil, darker yellow; rolling highland; level area in rolling field; drainage, natural; rotation of oats, wheat and clover; manure applied every 3 or 4 years; some fertilizer applied for wheat; red clover grown; does fairly well.

**10-A.**—Discard, 8.41%. Across road from barn; cleared 20 years; soil, light yellow; subsoil, yellowish; level highland terrace; drainage, natural; rotation of corn, wheat, clover and timothy; manure applied occasionally; some fertilizer; some hydrated lime; red clover grown; red clover does fairly well; considerable sorrel.

**11-A.**—Discard, .78%. Near bridge southeast of farm; cleared 20 to 30 years; soil, reddish; subsoil, reddish; level terrace; drainage, natural; rotation of tomatoes, wheat and clover; mixed fertilizer applied; some lime; red clover grown; red clover does fairly well.

**12-A.**—Discard, .94%. Terrace back of orchard; cleared 50 years; soil, light gray; rolling terrace; drainage, natural; corn and hay grown; some clover grown; sorrel and poverty grass, the principal weeds.

**13-A.**—Discard, 15.8%. Across road from schoolhouse; cleared 50 years; soil, light gray; level terrace; drainage, nat-

ural and some artificial; land mostly in meadow, now in cowpeas; some fertilizer applied; cowpeas grown; corresponding land not tile drained shows very poor meadows full of sorrel, broomsedge, etc.

**14-A.**—Discard, 4.44%. Center of farm; oak, cherry and some poplar originally grew on land; cleared 100 to 125 years; rolling highland; drainage, natural; rotation 3 years; corn, oats, clover and potatoes; yield, oats 25 bushels, corn 60 bushels, clover 2 tons, potatoes 200 bushels; some manure applied each three years; 200 pounds acid phosphate on all except potatoes; 1600 pounds home mixed; no lime; clover grown; red clover does fairly well; joint grass and foxtail, the principal weeds.

**15-A.**—Discard, 3.65%. South of house along road; oak originally grew on land; cleared over 100 years; soil, light brown; subsoil, dark yellow mottled; nearly level terrace; drainage, natural; meadow, one crop of corn 15 years ago; about one ton per acre; timothy predominates; no red clover sown; moss, sedge, running briers, cinquefoil, and yarrow, the principal weeds.

**16-A.**—Discard, 1.55%. Experiment Station plots; soil, light yellow; level highland; drainage, natural and artificial; variety of crops grown; plot 21; no manure applied; no fertilizer; no lime; red clover does not do well; sorrel and yellow trefoil, the principal weeds.

**17-A.**—Discard, 20.39%. Pine knob; cleared 5 years; soil, light brown; subsoil, yellowish brown; rolling highland; drainage, natural; orchard; crimson clover grown; sorrel, the principal weed; land cleared and farmed years ago but allowed to run wild again.

**18-A.**—Discard, 2.05%. Orchard on hill back of house; cleared 25 to 30 years; soil, red; subsoil, red; drainage, natural, not very good; orchard sown in clover; no manure applied; no lime; red clover grown; red clover does well.

**19-A.**—Discard, 26.41%. Oak land; cleared 5 years; soil, dark gray; subsoil, light gray; rolling highland; orchard; crimson clover grown; sorrel, the principal weed; cleared from forest years before but covered with second growth and this cleared off about 5 years; drainage, natural.

**20-A.**—Discard, 80.34%. Recently cleared orchard land.

**21-A.**—Discard, 2.57%. Northeast of barn, second field; cleared many years; soil, light gray; subsoil, yellowish; roll-

ing highland or second terrace; drainage, natural; rotation of corn, wheat, hay and tobacco; very little manure applied; very little fertilizer; no lime; red clover very poor; sorrel, the principal weed; very poor growth of grass.

**22-A.**—Discard, .84%. South of Elmwood church; cleared 50 years; soil, grayish; subsoil, grayish; level terrace; drainage, natural; rotation of corn, wheat, clover and tobacco; some manure applied; red clover grown; red clover does fairly well.

**23-A.**—Discard, 1.40%. Cleared many years; no rotation practiced; yield of crops not known; last potatoes no good; do not know what grasses predominate; no fertilizer applied; no lime; some white clover grown; red clover does not do well; milkweed, the principal weed.

**24-A.**—Discard, 41.74%. Cleared over 50 years; Apple Pie Ridge; soil, yellow; subsoil, yellow; rolling highland; drainage natural; nothing but orchard; 3-year average, 79 barrels apples; 400 pounds yearly of 4-10-8 fertilizer; no lime; no legumes; red clover would do well if given a chance; cheat grass, the principal weed; a very profitable orchard.

**25-A.**—Discard, 32.28%. On top of ridge; cleared over 50 years; rolling highland; drainage, natural; nothing but orchard cultivation; 3-year average, 79 barrels apples per acre; 400 pounds yearly of 4-10-8 fertilizer; no legumes grown; never tried red clover; cheat grass the principal weed; a good yielder of apples.

**26-A.**—Discard, 33.33%. Center of farm; cleared over 50 years; soil, red; subsoil, red; rolling highland; drainage, natural; cover crops in fall; peaches good, apples only fair, about 40 barrels per acre; 4-10-7 fertilizer and lime applied occasionally; crimson clover and cowpeas grown; never tried red clover; good soil for peaches if nitrogen is added; a little light for apples.

**27-A.**—Discard, 46.78%. Cleared only 10 years; soil, yellow; subsoil, yellow; level; drainage, natural; cowpeas and soybeans grown; orchard: not bearing; 400 pounds 4-8-7 fertilizer applied now and then; yellow shale soil, naturally poor; trees show neglect soon; manures and clovers help considerably.

**28-A.**—Discard, 21.98%. Soil, brown; subsoil, brown; Apple Pie Ridge; rolling highland; drainage, natural; 3-year average, 79 barrels per acre; 400 pounds 4-8-7 fertilizer

yearly; cover crops 10 year ago; cheat grass, the principal weed; heavy growth of cheat grass plowed under each year.

**29-A.**—Discard, 11.06%. Cleared 75 years; soil, yellowish brown; subsoil, yellow to brown; rolling highland; drainage, natural; corn grown only when orchard is young; orchard not bearing; 300 pounds 4-10-8 fertilizer applied occasionally; some clover grown; orchard about 10 years; not taking inter-crops off any more; good soil; outcrops of limestone.

**30-A.**—Discard, 52.30%. Cleared 50 years; soil, yellow; subsoil, yellow; rolling highland; drainage, natural; rotation of corn, oats and wheat; low yield; very little manure applied; 200 pounds 0-8-3 fertilizer applied occasionally; ground poor, trees doing poorly.

**31-A.**—Discard, 20.31%. Soil, yellow; subsoil, yellow; level overflow; drainage, natural; good apple yield, 60 barrels per acre; light applications of manure; just out of soapstone area; raising good crops.

**32-A.**—Discard, 17.39%. Cleared 50 years; soil, brown to black; subsoil, brown; level; no rotation practiced; 68 barrels apples per acre; 400 pounds 2-10-8 fertilizer yearly; crimson clover grown; red clover does well; good soil; high-producing orchards; clovers always plowed under.

**33-A.**—Discard, 40.23%. Cleared 50 years; soil, yellowish brown; subsoil, yellow; drainage, natural; good yield; manure occasionally applied about weak trees; 300 to 400 pounds 4-10-8 fertilizer when cropped; crimson clover grown; red clover does well; a good orchard on Apple Pie Ridge, well taken care of.

**34-A.**—Discard, 59.04%. Pine originally grew on land; cleared 40 years or more; soil, blue to gray; subsoil, bluish gray; (black slate); drainage, natural; yield low, about 30 barrels apples; occasionally 200 pounds 4-8-10 fertilizer applied; red clover does well; poor soil; manures and clovers help wonderfully.

**35-A.**—Discard, 16.08%. Pine originally grew on land; cleared 30 years or more; soil, yellow to bluish; subsoil, yellow and black slate; rolling terrace; drainage, natural; yield not very high; fertilizer applied occasionally; crimson clover grown; red clover does well.



**36-A.**—Discard, 41.12%. Cleared 40 years or more; soil, yellow to brown; subsoil, yellow; Apple Pie Ridge; rolling highland; yield high, 70 barrels; manure occasionally about trees; 4-10-8 fertilizer when crop is present; crimson clover grown; red clover does well; good soil; a good orchard well taken care of.

**37-A.**—Discard, 7.07%. Cleared 40 years; soil, yellowish brown; subsoil, yellow; level; drainage, natural; clean cultivation now; not bearing; manure and 4-10-8 fertilizer occasionally applied; some crimson clover grown; red clover does well.

**38-A.**—Discard, 11.19%. Cleared 40 years at least; soil, brown; subsoil, brown to yellow; rolling terrace; drainage, natural; yield good, 70 barrels average; manure applied occasionally; 500 pounds 4-10-8 fertilizer applied yearly; burned lime applied 1-10 years; crimson clover grown; red clover does well; good orchard; good management; cheat grass; outcrop of limestone.

**39-A.**—Discard, 1.32%. South of house; oak land; cleared 80 years; soil, chocolate; subsoil, yellowish; rolling highland; drainage, natural; yield rather low but getting better; no manure applied; fertilized heavily last few years; no lime; red clover grown; sorrel, the principal weed; probably in tobacco for years but for last 20 years corn, buckwheat, timothy and clover.

**40-A.**—Sugar and black walnut originally grew on land; cleared 65 to 70 years; soil, black; subsoil, gray; level, first bottom; drainage, natural; rotation of corn, oats, clover and timothy; no manure applied; no fertilizer; no lime; clover grown; red clover does well; present ownership 18 years; previous to this land had been poorly farmed.

**41-A.**—Discard. A typical black sand.

**42-A.**—West of road; cleared a great many years; soil, dark red; subsoil, red; rolling highland; rotation of corn, wheat and hay; little manure applied; no fertilizer; no lime; clover grown; soil covered with fragments of limestone; at present land is in alfalfa.

**43-A.**—Southwest of barn; oak, sugar, beech and poplar originally grew on land; cleared 75 or 80 years; soil, chocolate; level terrace; needs drainage; rotation of corn, wheat and timothy; 40 or 50 bushels corn; several applications of ma-

nure; no fertilizer; no lime; once in cowpeas, once in beans; clover formerly did well, though not now; pea vines, the principal weeds.

**44-A.**—South of house; oak and maple originally grew on land; cleared 40 to 50 years; soil, dark gray; subsoil, mottled; level bottom swamp; mostly grass, corn years ago; no manure applied; no fertilizer; no lime; typical "Meadows" from Little Clear Creek.

**45-A.**—Practically same as 44-A from wet undrained bottom meadow land.

**46-A.**—West of barn; oak and chestnut originally grew on land; cleared 75 years; soil, chocolate; subsoil, dark brown; level highland; rotation of corn, oats, wheat and hay; manure applied occasionally; acid phosphate 10-12 years; no lime; red clover grown; typical soapstone land.

**47-A.**—South of barn; oak, poplar and walnut originally grew on land; cleared 75 years; soil, dark gray; subsoil, light gray; mostly pasture for some time; some manure applied; no fertilizer; no lime; red clover grown. This should be typical limestone soil.

**48-A.**—Lower end of Buffington Island. This sample was taken from side of exposed strata along river shore where river had cut away into the bank.

**49-A.**—Cottonwood and sycamore originally grew on land; cleared 75 years or more; soil, black; subsoil, dark brown; level overflow; drainage, natural; all corn, occasionally watermelons; 60 to 65 bushels per acre; no manure applied; no fertilizer; no lime; no legumes grown; red clover does well; smartweed and pigweed, the principal weeds; very good corn land; potatoes do not do particularly well. This soil is from lower bottom, overflowing every year.

**50-A.**—Cottonwood and sycamore originally grew on land; cleared 75 years or more; soil, dark brown; subsoil, dark brown; level overflow; drainage, natural; all corn; 60 to 65 bushels per acre; no manure applied; no fertilizer; no lime; no legumes grown; red clover does well; smartweed and horseweed, the principal weeds; very good corn land; potatoes do not do very well; soil from upper bottom, overflowing every few years.

**51-A.**—Oak, pine and hickory originally grew on land; cleared 50 years; soil, reddish; subsoil, red; level terrace;

drainage, natural; rotation of corn, wheat, clover and timothy; 50 bushels corn, 12 bushels wheat; no manure applied; no fertilizer; no lime; clover grown; red clover does well; foxtail, ragweed, etc., the principal weeds; common type of small stream bottom soil in West Virginia, with Upshur highlands surrounding it.

**52-A.**—Oak, pine and hickory originally grew on land; cleared 5 years; soil, dark gray; subsoil, yellowish; steep highland; drainage, natural; pasture land; never in crops; bluegrass predominates; no manure applied; no fertilizer; no lime; no legumes grown; do not know if red clover does well; ragweed, sumac bushes, the principal growth; as near "virgin" soil as any in locality; example of soil which is cleared and no crops have since been removed; has been pastured very lightly.

**53-A.**—Creek bottom; oak, cottonwood and sycamore originally grew on land; cleared 50 years; soil, reddish brown; subsoil, red; level overflow and terrace; drainage, natural; corn and grass; no system until recently; 35 bushels corn; 2 tons hay; no manure applied; no fertilizer; no lime; clover grown; red clover does well; crab grass, ragweed and morning glory, the principal weeds.

**54-A.**—South side creek bottom; sycamore, cottonwood and oak originally grew on land; cleared 50 years; soil, reddish brown; subsoil, red; level overflow and terrace; drainage, natural; corn and grass; no system until recently; 35 bushels corn, 2 tons hay; no manure applied; no fertilizer; no lime; red clover grown; red clover does well; ragweed, crab grass and morning glory, the principal weeds.

**55-A.**—Center of farm; oak, hickory, tulip and pine originally grew on land; cleared 100 years; soil, light gray; subsoil, yellow; level terrace; drainage, natural; rotation of corn, timothy and cowpeas; 50 bushels corn; Japan clover, broomsedge and foxtail predominate; manure applied three times in last 6 years, thin 8 tons; 14% acid phosphate, 350 per acre; no lime; to be applied soon; cowpeas, crimson clover and red clover grown; red clover does not do well; foxtail, ragweed, sorrel and broomsedge, the principal weeds. This soil was very much depleted during slavery times; is oldest farm in country; was very much run down until about eight years ago; present owner has applied much fertilizer, at first bone meal, now acid phosphate.

**56-A.**—Oak, hickory, locust and tulip originally grew on land; cleared 75 years ago but has been in pasture and thicket

for 30 years; soil, gray; subsoil, reddish yellow; rolling highland; drainage, natural; pasture land; wild grasses, Canadian bluegrass and some Kentucky bluegrass; no manure applied; no fertilizer; no lime; do not know if red clover does well; sorrel, broomsedge and blackberries, principal growth; is to be cleared for peach orchard this year; was in locust and persimmon thicket until 2 years ago.

**57-A.**—Oak, hickory, poplar and ash originally grew on land; cleared 25 years; soil, light gray; subsoil, yellow; level terrace; drainage, natural; rotation of corn, wheat, clover and timothy; 35 bushels corn, 12 bushels wheat, 1 ton hay; poverty grass, foxtail and red top predominate; manure applied occasionally in spots; 16% acid phosphate, 400 pounds per acre every 4 years, and 2-8-2 before 1906; no lime; clover grown; red clover does only fairly well; foxtail and ragweed, the principal weeds.

**58-A.**—Oak and poplar originally grew on land; cleared 10 to 15 years; soil, grayish; subsoil, yellow; rolling highland; drainage, natural; sod; no manure applied; no fertilizer; no lime, no legumes; red clover does well; cinquefoil, the principal weed.

**59-A.**—Southeast of barn; white oak originally grew on land; cleared 50 years; soil, dark red; subsoil, dark red; rolling highland; poor drainage, too tenaceous; farmed perhaps earlier but last 30 years allowed to run to grass and underbrush; grubs, sorrel, etc., predominate; little manure applied; little fertilizer; no lime; red clover does well; wild sweet potatoes; briers and milkweed, the principal weeds.

**60-A.**—White oak originally grew on land; cleared 50 to 60 years; soil, red; subsoil, red; rolling highland; pasture, corn and wheat; 15 bushels wheat, 60 bushels corn; no manure applied; fertilizer applied once; no lime; no legumes grown; red clover does well; some sorrel.

**61-A.**—Discard, 2.21%. Oak and poplar originally grew on land; cleared 100 years; soil, yellowish; subsoil, light yellow; rolling highland; drainage, natural; poverty grass, etc., predominate; no manure applied; no fertilizer; no lime; legumes grown very little. This soil was in tobacco for years, but of late years has been practically abandoned and let go to briers, etc.

**62-A.**—South of barn; sugar trees originally grew on land; cleared 75 years; soil, reddish; subsoil, reddish; level

overflow; drainage, artificial; rotation of corn and wheat for 50 years; 60 to 70 bushels of corn; no manure applied; no fertilizer; no lime; very little clover; red clover does well; excellent land; overflows once a year.

**63-A.**—South of locks; cleared 100 years; soil, dark gray; subsoil, grayish; level overflow; drainage, natural; corn and wheat for years; 60 to 100 bushels corn, 20 to 30 bushels wheat; manure applied once or twice; no fertilizer; a little lime; clover grown; red clover does well. This land was overflowed in 1913 and covered with sand, etc.

**64-A.**—Discard, 23.12%. White oak originally grew on land; cleared 35 years; soil, dark brown; subsoil, reddish; rolling highland; corn and wheat, mostly wheat; 12 to 15 bushels; bluegrass predominates; no manure applied; no fertilizer; no lime; cowpeas a few years; red clover does well. The limestone outcrop was in form of good sized slabs mixed with the soil.

**65-A.**—Discard, 2.12%. North of barn; oak and poplar originally grew on land; cleared 75 years; soil, grayish; subsoil, yellowish; rolling highland; drainage, natural; corn, oats and hay, also wheat; manure applied every few years; a little complete fertilizer applied; no lime; red clover sown; sapling clover does well; yarrow, cinquefoil, sorrel and some poverty grass, the principal weeds.

**66-A.**—Discard, 5.49%. One mile north of Masontown, 100 yards east of pike; oak, maple and chestnut originally grew on land; cleared 20 years; soil, light brown; subsoil, light yellow; rolling highland; drainage, natural; corn, wheat, grass; pasture mostly; 60 bushels corn, 1½ tons hay; now in potatoes; 3 cattle supported to the acre; manure applied twice, 4 tons per acre; acid phosphate, 16%, 500 pounds per acre; 2 tons lime per acre; clover grown; red clover does well; cinquefoil and briars, the principal weeds; now in fine cultivation; promises 150 bushels potatoes per acre; rather loose and friable; one of the typical potato soils.

**67-A.**—Discard, 5.79%. 150 yards northeast of barn; oak, walnut, and locust originally grew on land; cleared 50 years; soil, brown; subsoil, light yellow; rolling highland; drainage, natural; corn, oats, grass (mowed 3 times); pasture before; 50 bushels corn, 40 bushels oats; bluegrass and redtop predominate; 3 acres per steer; manure applied 3 times, 8 tons to the acre; 200 pounds 16% acid phosphate to the acre; limed

10 years ago, 125 bushels; good clover; red clover does well; yarrow and cinquefoil, the principal weeds; north end of hill typifies best pasture land in district.

**68-A.**—Discard, 2.16%. One-half mile west of house; water oak, ash, and hickory originally grew on land; cleared 40 years; soil, black to gray; subsoil, bluish gray; level overflow; no drainage; pasture; bluegrass, swamp; no manure applied, no fertilizer, no lime; iron weed, mint, alders, and some sorrel, the principal growths.

**69-A.**—Discard, 20.00%. Southeast of house; white oak originally grew on land; cleared 50 years; soil, dark brown; subsoil, light yellow; rolling highland; drainage, natural; rotation of corn, oats, wheat, and grass; 50 bushels corn; manure applied once in five years; acid phosphate and bone applied; lime applied two or three times, not for 8 or 9 years; some clover grown; red clover does well.

**70-A.**—Discard, 6.85%. Southeast of barn; oak, chestnut, poplar, and sugar originally grew on land; cleared 75 years; soil, light brown; subsoil, yellowish; rolling highland; rotation of corn, oats, buckwheat, and potatoes; 50 bushels corn; no manure applied for 5 years; some fair grade fertilizer and acid phosphate applied; limed every time plowed for 5 years; mostly timothy grown; red clover does fairly well; no sorrel, buck plantain.

**71-A.**—Discard, 15.00%. Southeast of barn; poplar and oak originally grew on land; cleared 75 years; soil, brownish red; subsoil, brick red; rolling highland; drainage, natural; rotation of corn, oats, timothy, and clover; 50 bushels corn; manured 3 times in 12 years; acid phosphate applied about 6 times in 12 years; limed 12 years ago, before that had several heavy applications; clover grown; red clover does well; rattle weed and deer tongue, the principal weeds. This farm has been farmed for 75 years and had been worn to the point 25 years ago where it was very unproductive.

**72-A.**—Discard, 3.11%. Northwest of barn; sugar maple and oak originally grew on land; part cleared 25 years, remainder 50 years; soil, dark brown; subsoil, yellowish; rolling highland; drainage, natural; potatoes, oats, and buckwheat grown; 150 bushels potatoes, 30 bushels buckwheat; several applications of manure; acid phosphate applied; several applications of lime; red clover grown; red clover does well. This is a typical potato and buckwheat soil.

**73-A.**—Discard, .51%. Bottom south of house; sugar trees originally grew on land; cleared 50 years; soil, red; subsoil, reddish; level overflow; no drainage; corn principally, some meadow; good corn land; no manure applied, no fertilizer, no lime; white clover grown; red clover does well.

**74-A.**—Discard, 1.80%. Northeast of barn; cleared 50 years; soil, grayish; subsoil, yellowish; rotation of corn, wheat, and timothy; a little manure applied, no fertilizer, no lime; some clover grown; red clover does not do very well.

**75-A.**—Discard, 3.93%. West of house; beech and sugar originally grew on land; cleared 50 or 60 years; soil, dark brown; subsoil, light brown; level terrace; rotation of tobacco, corn, and wheat; some manure applied, some fertilizer, no lime; red clover does well. This should be a typical sample of tobacco soil. Grows best quality Burley of reddish yellow color.

**76-A.**—Discard, 1.40%. South of barn; cleared 75 years; soil, gray; subsoil, yellowish; level terrace; rotation of corn, oats, wheat, and timothy; some manure applied, not much, no fertilizer, no lime; no legumes grown; red clover does not do well; poverty grass and mint, the principal weeds. This soil is very unproductive at present. It is covered with poverty grass although it has been sown to timothy.

**77-A.**—Discard, 1.38%. Soil, light gray; subsoil, bluish; level terrace; no drainage; no rotation; oats poor crop; no manure applied, no fertilizer, no lime; no legumes grown; red clover does not do well; land seriously in need of drainage; quite flat; this sample typical of large area of this kind of land.

**78-A.**—Discard, 1.76%. Soil, light red; subsoil, yellowish; corn and timothy grown.

**79-A.**—Discard, 1.69%. West of house; cleared 50 years; soil, brown; subsoil, light brown; level terrace; rotation of wheat, corn, and timothy, mostly wheat; not much manure applied, no fertilizer, one application 2000 pounds  $\text{CaCO}_3$ ; no legumes grown lately; red clover does not do very well.

**80-A.**—Discard, .84%. East of barn; cleared 75 years; soil, dark gray; subsoil, light gray; level overflow; rotation of corn, wheat, and timothy; manure applied occasionally, fertilizer occasionally, one application of lime last year; clover grown; red clover does fairly well.

81-A.—Discard, 15.75%. North of barn; oak, hickory, beech, and walnut originally grew on land; cleared 10 years; soil, dark brown; subsoil, yellow; rolling highland; drainage, natural; rotation of corn, oats, and clover; 40 bushels corn, 50 bushels oats, 1½ tons clover; bluegrass predominates; no manure, no fertilizer, no lime; clover grown; red clover does fairly well; milkweed, briars, and whitetop, the principal weeds.

82-A.—Discard, 2.03%. North of house; cleared 50 years; soil, light red; subsoil, light red; rolling highland; rotation of corn, wheat, and timothy; yield not very high; no manure applied, no fertilizer, no lime; no legumes grown.

83-A.—Discard, 2.05%. North of barn; heavily manured; this sample is typical but has been heavily manured and is underlain with mussel shells evidently left by Indians.

84-A.—Discard, 1.46%. Cleared probably 100 years; soil, light gray; subsoil, yellowish; level terrace; rotation of corn, wheat, and timothy; very little manure applied, no fertilizer, no lime; red clover does not do well; typical of soils in Teays Valley; soil covered with cinquefoil; very little grass.

85-A.—Discard, 1.21%. Hickory originally grew on land; cleared 100 years; soil, dark gray; subsoil, yellow and blue; artificial drainage; before draining, swampy; meadow up to 20 years ago; 3 tons hay; 80 bushels corn; 5 applications of 8 tons of manure, 2500 pounds acid phosphate; limed, 1 ton CaO per acre; clover and cowpeas, mostly clover; red clover does well; some sorrel. This sample represents the flat land.

86-A.—Discard, 4.16%. North of buildings; oak, walnut, and sycamore originally grew on land; cleared 50 years; soil, black; subsoil, olive; level overflow; artificial drainage needed; no rotation in old meadow; consists of yarrow, daisy, poverty grass, and is a typical "run down" meadow.

87-A.—Discard, 8.48%. South of barn; oak, chestnut, and some poplar originally grew on land; cleared 75 years; soil, light brown; subsoil, yellowish; rolling highland; drainage, natural; corn, wheat, largely grass; sorrel, briars, etc., predominate; no manure applied, no fertilizer, no lime; no legumes grown; red clover does not do well; rock close to surface.

88-A.—Discard, 1.88%. Poplar, beech, and sugar originally grew on land; cleared 50 years; soil, brown; subsoil, brown; level overflow; artificial drainage; mostly meadow,



some corn and some oats; 75 bushels corn; a little manure applied, a little fertilizer, a little lime; no legumes grown; limestone on tops of hills in small amounts.

**89-A.**—Discard, 2.77%. South of house; oak, hickory, and walnut originally grew on land; cleared 100 years; soil, dark brown; subsoil, chocolate; rolling highland; drainage, natural; rotation of corn, oats, and clover; 50 bushels corn, 40 bushels oats, 1 ton hay.

**90-A.**—Discard, 7.31%. East of barn; sugar trees originally grew on land; cleared 100 years; soil, dark brown; subsoil, yellowish; rolling highland; drainage, natural; pasture more than  $\frac{1}{2}$ , farmed 12 or 15 years; 60 bushels corn, 2 tons soybean hay; only 1 application of manure, 4 or 5 applications 250 pounds phosphate; limed once, 1 ton  $\text{CaO}$ ; 2 crops soybeans, 1 crimson clover; red clover does well; sorrel, the principal weed. This sample represents the hill land under cultivation.

**91-A.**—Discard, 9.88%. Northeast slope, oak originally grew on land; cleared 75 years; soil, light brown; subsoil, yellowish; rolling highland; drainage, natural; mostly grass and pasture; poverty grass predominates; no manure applied, no fertilizer, no lime; no legumes grown; red clover does not do well; sorrel, the principal weed; typical poverty grass, northeastern slope.

**92-A.**—Discard, 10.42%. Northwest slope; walnut and poplar originally grew on land; cleared 75 years; soil, dark brown; subsoil, yellowish; rolling highland; drainage, natural; bluegrass and poverty grass predominate; no manure applied, no fertilizer, no lime; no legumes grown. This is same soil as 91-A, that is, it is derived from the same rock but has northwestern exposure instead of northeastern.

**93-A.**—Discard, .76%. South of barn; pine land; cleared 100 years; soil, grayish; subsoil, yellowish; under cultivation, corn, wheat, and timothy; no manure applied, no fertilizer; 2000 pounds  $\text{CaCO}_3$  applied; soybeans grown; red clover does well; sorrel, the principal weed; this sample from farm which has been farmed for 100 years and is just now being well farmed.

**94-A.**—Discard, 1.01%. Northeast of barn; soil, grayish; subsoil, light gray; level terrace; rotation of corn, wheat, and timothy; little manure applied, no fertilizer; no legumes grown.

**95-A.**—Discard, 2.20%. Near barn; cleared 100 years; soil, chocolate; subsoil, yellowish; level terrace; in grass for years, farmed to alfalfa and corn; excellent corn crop now; bluegrass predominates; some manure applied, some acid phosphate, two applications of lime for alfalfa; alfalfa and red clover grown; red clover does well; this has probably been influenced by limestone from adjacent hill in which there is thin ledge. This had been bluegrass pasture for years.

**96-A.**—Discard, 1.04%. Oak, sycamore, and sugar originally grew on land; cleared 85 years; soil, reddish; subsoil, chocolate; level overflow; drainage, natural; rotation of corn, oats, and grass; 70 bushels corn; very little manure applied, some fertilizer, 1 ton lime per acre. The soil has been filled in largely the last ten years by overflow.

**97-A.**—Discard, 1.96%. Top of hill back of barn; cleared 50 years; soil, whitish; rolling highland; drainage, natural; hay grown; timothy predominates; acid phosphate applied; sorrel, the principal weed; land practically bare when Mr. Hardman bought it; treated with acid phosphate and got good crop of timothy.

**98-A.**—Discard, 1.11%. Sugar and oak originally grew on land; cleared 100 years; soil, light brown; subsoil, yellowish; level terrace, corn and wheat for years, under cultivation  $\frac{3}{4}$  of 100 years; 50 bushels corn; 4 or 5 applications of manure, 4 or 5 small applications of fertilizer, limed twice; clover grown; red clover does fairly well; considerable plantain.

**99-A.**—Discard, 5.71%. Next creek; oak and hickory originally grew on land; cleared 50 years; soil, chocolate; subsoil, yellow; rolling terrace; drainage, natural; no rotation practiced; poverty grass, briars and redtop predominate.

**100-A.**—Discard, 1.40%. West of barn; land originally swamp; soil, black; subsoil, black; level overflow; artificial drainage 35 years ago but re-drained the last few years; grass, corn now; no manure applied, no fertilizer, no lime; no legumes grown.

**101-A.**—Discard, 2.25%. Soil, black; subsoil, yellowish; soil good for corn but unsatisfactory for grass.

**102-A.**—Discard, 1.05%. West of house; cleared 100 years; soil, reddish; subsoil, reddish; level overflow; drainage, natural; rotation of corn, wheat, timothy, and some clover; manure applied occasionally, some fertilizer, no lime; clover

grown occasionally; red clover does fairly well; this represents a flat field which overflows yearly or nearly that often; nice bottom field.

**103-A.**—Discard, 1.21%. Southeast of barn; sugar trees originally grew on land; cleared 10 years or so; soil, dark gray to brown; subsoil, brown; level overflow; no drainage; grass and pasture; no manure applied, no fertilizer, no lime; no legumes; some limestone upstream.

**104-A.**—Discard, 12.56%. East of house; cleared 50 years or more; soil, brown; subsoil, yellowish; land in grass; 5 acres or more to a steer; poverty grass and such grasses predominate; no manure applied, no fertilizer, no lime; no legumes grown; red clover does not do well; has been in meadow and pasture and nothing ever done but mow hay and pasture.

**105-A.**—Discard, 1.50%. Southwest of barn; white oak originally grew on land; cleared 75 years; soil, gray; subsoil, yellowish; rolling highland; drainage, natural; rotation of corn, wheat, timothy, and oats; some manure applied, very little, no fertilizer, no lime; legumes grown very little; red clover does not do well; poverty grass and wire grass, the principal weeds; this is typical of rather white soil of Jackson County.

**106-A.**—Discard, 1.07%. East of barn; white oak originally grew on land; soil, light brown; subsoil, yellowish; rolling terrace; drainage, natural; soil in poor shape and has not been well farmed for years.

**107-A.**—Discard, 7.40%. Southeast of barn; oak and pine originally grew on land; cleared 75 years, second growth until 5 years ago; soil, grayish; subsoil, yellowish; rolling highland; corn, wheat, and timothy years ago; some fertilizer applied, no lime; Legumes do not grow well; red clover does not do well; sorrel, poverty grass, pennyroyal, and cinquefoil, the principal weeds; has been farmed for years and then allowed to grow up to underbrush.

**108-A.**—Discard, 1.20%. Northeast of house; oak originally grew on land; cleared 12 years; soil, gray; subsoil, yellowish; level highland; drainage, natural; orchard; no manure applied, no fertilizer, no lime; red clover does well; sorrel, the principal weed.

**109-A.**—Discard, 6.19%. North of church; oak and chestnut originally grew on land; cleared 75 to 100 years; soil,

grayish; subsoil, yellow; rolling highland; drainage, natural; rotation of corn, oats, wheat, and timothy; very little manure applied, a little fertilizer, no lime; no clover ever sown, do not know if red clover does well; cinquefoil, sorrel, and poverty grass, the principal weeds; this sample chosen from poorly farmed area now in meadow adjoining the church yard.

110-A.—Discard, 1.03%. Poplar originally grew on land; cleared 75 years; soil, chocolate; subsoil, chocolate; level terrace; drainage, natural; corn, wheat, and timothy, is now in watermelons; some manure applied, no fertilizer, no lime; legumes not grown to amount to anything; red clover does not do very well. This is excellent and typical watermelon soil.

111-A.—Discard, 2.45%. West of town; soil, yellowish brown; drainage, natural; covered with very poor wheat; probably never had any lime or fertilizer and very little manure.

112-A.—Discard, 2.31%. Poplar, sugar, and oak originally grew on land; cleared 100 years; soil, red; subsoil, red; rolling highland; drainage, artificial; alfalfa, cowpeas, clover several times; 3 tons alfalfa, 75 bushels corn; manured 7 or 8 times, 3000 pounds acid phosphate, 3 tons CaO last 10 years; red clover does well.

113-A.—Discard, 3.61%. West of barn; chestnut originally grew on land; cleared 75 or 100 years; soil, light brown or gray; subsoil, yellowish; rolling terrace; drainage, natural; briars and broomsedge, corn this year; one application of manure, two or three applications of fertilizer, no lime; no legumes grown.

114-A.—Discard, 13.51%. West of house; white oak originally grew on land; cleared 25 years; soil, light gray; subsoil, yellowish; level highland; rotation of corn, oats, and timothy; acre yield not very high; 2 or 3 applications of manure, 1 application of fertilizer, 1 ton CaO applied; some clover grown, now ready for alfalfa; red clover does not do very well. The surface was covered with fragments of sandstone.

115-A.—Drainage, artificial; rotation of corn, oats, wheat, clover, and timothy; for yield see Ohio circular 144; analysis, Ohio bulletin 261; 6 inches surface soil; phosphorus, 664; potassium, 33,110; nitrogen, 1778; humus, 18800; calcium, 4720; magnesium, 7778. This soil corresponds to soil on plots in five-year rotation which has never received any fertilizer or manure since the experiments were begun in 1893.

## INTERPRETATION OF ANALYSES.

Nitrogen, phosphorus, and potassium are three elements of plant food which may be present in available forms in such small amounts in the soil as to be limiting factors in crop production. The foregoing analyses show the total number of pounds of these elements present but not the number of pounds which are available. It is recognized that the amount of available plant food materials in the soil is determined by three things:

1. The total amount of these elements present in the soil.
2. The extent to which organic matter is incorporated with the soil.
3. The extent to which the soil can be kept supplied with carbonate of lime in order that the normal processes of decay may take place readily.

If two soils were equally supplied with organic matter and limestone, and one of these soils contained twice the amount of nitrogen, phosphorus or potassium as did the other, it seems reasonable to believe that the one containing twice the total amount of these elements would also be able to supply the crop being grown with twice the amount of these elements in available form.

In considering the subject of soil fertility from the long time point of view it seems desirable, therefore, to know the total amounts of nitrogen, phosphorus and potassium, the amount of organic matter and the amount of carbonate of lime present in the soil. Knowing these things, we can plan ahead more intelligently as to how to proceed toward a permanent system of soil building.

Table IV shows the average of all the analyses of West Virginia soils so far made. The amount of organic matter is calculated by multiplying the total carbon by 1.724 which would mean that organic matter was 58% carbon. The limestone requirement indicates the number of pounds of limestone necessary to destroy all the acid in the surface soil to plow depth. For most crops it is desirable to have the soil well supplied with limestone.

TABLE IV.—Pounds per 2,000,000 Lbs. of Surface Soil.

	Highest	Lowest	Average of All Soils	Plot 21, Exp. Sta. Farm
Nitrogen .....	6,485	1,035	2,915	1,830
Phosphorus .....	3,635	355	1,095	590
Potassium .....	143,000	1,200	30,610	24,200
Organic matter .....	302,800	26,200	57,800	36,500
Limestone requirement .....	6,800	0	2,170	2,800

A study of the analyses of these soils will show that many of them are seriously depleted of phosphorus, nitrogen, and organic matter. Over 90% of the soils of West Virginia show a need of lime. Most of the soils are fairly well supplied with potassium.

We prefer to wait until more analyses have been made before discussing these analyses in detail. However, Table IV also gives the analysis of one of the check plots on the Experiment Station farm at Morgantown, and this shows that the average West Virginia soil so far analyzed is better than that on the Experiment Station farm. But a careful study of the analyses will show that many of the soils of the state would probably respond to fertilizer treatment much the same as does the soil on the Experiment Station farm.\*

\*See "Experiments with Fertilizers," Bulletin 155, West Virginia Agricultural Experiment Station.



